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"AN AIR-BAG"

THE PRESENT INVENTION relates to an air-bag for use in a vehicle such as a motor car and more particularly relates to a side air-bag.

A side air-bag may be mounted in position, for example, in the backrest of a vehicle seat or in part of the side wall or a side door of the motor vehicle, the air-bag being configured, when inflated, to be located between the occupant of a seat and the adjacent side of the vehicle.

A side air-bag may prove to be of particular benefit in a side impact situation. However, in a side impact situation an intruding vehicle or object can, even at relatively low speeds, impact with an occupant of the vehicle very shortly after the impact situation has commenced, and consequently it is desirable to be able to inflate a side air-bag in the minimum amount of time. Consequently it is desirable to be able to inflate the side air-bag using a minimum quantity of gas.

However, it is also desired that a side air-bag should be as thick or "deep" as possible in the traverse direction across the vehicle, in order to provide the maximum cushioning effect for the occupant of a vehicle relative to an intruding vehicle or object.

Consequently it is desired to provide a side air-bag which can be inflated quickly using a minimum quantity of gas, but which has a relatively high thickness or "depth".

The present invention seeks to provide an improved side air-bag.

According to the present invention, there is provided a side air-bag for use in a motor vehicle, the side air-bag being formed from two superimposed layers of a laminar material, each layer having a leading edge and a trailing edge, there being at least one internal tether having opposed ends connected to the leading edge and the trailing edge, the length of the tether between the connections being less than the width of the said layers forming the air-bag between the said connections.

Preferably when the side air-bag is mounted in the motor vehicle, the or each tether is configured to extend in a direction substantially parallel to the longitudinal axis of the motor vehicle when the air-bag is inflated.

Advantageously there is a single tether.

Conveniently there are at least two tethers at spaced apart positions.

Preferably the air-bag is divided into two separate internal inflatable chambers by means of a seam interconnecting the said layers of laminar material.

Advantageously the width of each said layer of laminar material at the point where the tether is provided is W and the length of the or each tether is d, wherein $d < 2W/\pi$.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a plan view illustrating two components for forming an air-bag.

Figure 2 is a view of an air-bag formed from the components of Figure 1 illustrating additionally a gas generator and deflector;

Figure 3 is a view of a modified embodiment to the invention; and

Figure 4 is a view of a modified air-bag similar to that shown in Figure 2.

Referring initially to Figure 1 of the accompanying drawings, an element 1 of flexible laminar material such as fabric, is illustrated. It is to be understood that two components of the shape and form of the element 1 are to be superimposed and joined together to form an air-bag. Alternatively a single component of appropriate shape may be folded about a fold line to provide the two superimposed elements.

The element 1 has a central substantially rectangular region 2 with rounded corners. The rectangular region 2 has a leading or forward edge 3 and a trailing or rearward edge 4. The forward edge 3 forms that part of the air-bag which will be towards the front of the vehicle when the air-bag is in position in the vehicle and inflated, and the rearward edge 4 is the edge of the air-bag which will be towards the rear of the vehicle when the air-bag is in position in the vehicle and inflated.

The rearward or trailing edge 4 is provided with a rearwardly projecting portion 5 located substantially at its mid point. The projecting portion 5 is provided with two apertures 6, 7 therein at spaced apart positions.

The overall width of the element 1, from the leading edge 3 to the trailing edge 4 is a width W.

A further component 8 is illustrated in the form of a tether. The component 8 is a rectangular element of flexible laminar material such as fabric. The element has a length d, the length d being such that, preferably,

$d < 2W/\pi$.

In fabricating an air-bag, two elements such as the element 1 are superimposed, with a tether 8 inserted between them. The two superimposed elements are interconnected by means of a peripheral seam 9 as shown in Figure 2 which extends around the periphery of the superimposed elements 1 except for the region at the end of the rearward projection 5 formed in the trailing edge 4 of the superimposed layers. The internal tether 8 is secured, adjacent the rearward projection 5, to at least one of the layers 1 by the stitching the seam 9, or forming the seam 9 using some other technique. The

leading or forward edge 3 of each element 1 is slightly back towards the trailing edge 4 as the air-bag is fabricated so that the leading or forwardmost edge of the tether 8 may be trapped in the region of the seam adjoining the leading or forward edges of the elements 1. The two elements, at least in the region of the tether, will be wrinkled and will not lie flat. It is to be understood that the width of the fabric of the elements between the points at the leading and trailing edge, where the tether is secured to the fabric, is greater than the length of the tether between said points, which means that some wrinkles or folds must be present in the fabric.

A cylindrical gas generator 10 may be provided to be mounted within the air-bag, the gas generator 10 having a cylindrical body 11 with two parallel and radially extending studs 12, 13. The cylindrical body 11 may be provided with gas outlet apertures 14. In conjunction with the gas generator 10, a protecting element or gas diffuser 15 may be provided, the protecting element 15 being of open-channel-form and being provided with two apertures 16, 17 located and configured to receive the studs 12, 13. The protector 15 may be mounted on the studs 12, 13 of the gas generator 10 to form a gas generator unit and the thus-assembled gas generator unit may be inserted into the air-bag through the opening formed by the un-connected peripheral parts of the superimposed elements 1 in the region of the co-aligned rearward projections 5. When the gas generator unit has been inserted into the air-bag, the studs 12, 13 may be passed through the apertures 6, 7 in each of the projections 5, thus effectively sealing the air-bag.

The air-bag, as thus described, may be mounted in a motor vehicle at a suitable position for the air-bag to act as a side air-bag, and thus the air-bag may be mounted in the backrest of a vehicle seat or in part of the side wall of the vehicle adjacent a vehicle seat.

On deployment of the air-bag, gas from the gas generator will be injected into the air-bag. The effect of the tether 8 will be to prevent the forward or leading edge 3 of the air-bag from moving a substantial distance in the x direction (or main longitudinal axis) of the motor vehicle (as indicated in Figure 2) from the rear or trailing edge 4, thus forcing the air-bag to adopt a pre-determined shape on inflation. It should be appreciated that the x-direction is the direction of forwards travel of the motor vehicle. In the absence of an internal tether, such as the tether 8, the air-bag, if sufficient gas is injected into it, would tend to adopt a generally cylindrical format. However, in view of the presence of the tether, the leading or forward edge 3 of the air-bag cannot move sufficiently far away from the rear or trailing edge 4 in the x direction to form a cylinder, but instead the air-bag is inflated to have a very substantial thickness or depth in the orthogonal y-direction (transverse with respect to the longitudinal axis of the motor vehicle), whilst not extending very far forwards relative to the gas generator. The y-direction is shown in Figure 2 extending out of the page. The air-bag thus provides an optimum dimension in the direction where energy is to be absorbed.

Figure 3 illustrates a modified embodiment of the invention. Figure 3 shows a complete air-bag 20 which is formed from two substantially identical superimposed elements 21, 22, of flexible laminar material such as fabric although the air-bag could be formed using a one piece weaving technique. The air-bag is provided with a peripheral outer seam 23 interconnecting the elements 21, 22, and presents a leading edge 24 and a trailing edge 25 in a similar manner to the above-described embodiment of figures 1 and 2. The trailing edge 25 of the air-bag 20 is provided with a slit or opening 26 through which a gas generator may be inserted into the interior of the air-bag. The air-bag is also provided with two spaced apart apertures 27, 28 adjacent the slit 26,

which are dimensioned to accommodate the studs of a gas generator assembly, equivalent to the studs 12, 13 of the gas generator 10 described with reference to Figure 2.

The air-bag, in the described embodiment, is divided into two separate internal inflatable chambers 28, 29 by means of an internal seam 30 interconnecting the elements 21, 22.

Two tethers 31, 32 are provided on the interior of the air-bag 20, and again each tether 31, 32 is such that the length of the tether extending between points of the leading edge 24 and the trailing edge 25 where the tether is connected tot he fabric elements 21, 22 is less than the width of each of the fabric elements 21, 22 between said points. Again the purpose of the tethers 31, 32 is to ensure that the air-bag has an appropriate configuration when it is inflated, in a generally similar manner to the embodiment of figures 1 and 2.

The two tethers 31, 32 of the embodiment of figure 3 can either be configured to be of equal length to one another or such that they are of unequal lengths (as illustrated in figure 3) . By varying the relative lengths of the two tethers 31, 32, different inflation characteristics can be imparted to the airbag 20.

Figure 4 shows an air-bag 40 which is similar to the air-bag shown n Figure 2, the air-bag being provided with an internal tether 41 which extends diagonally from the forward or leading edge to the trailing edge. In this embodiment, although the tether 41 may have a length which is greater than the width of the air-bag, measured horizontally, nevertheless, the length of the tether between the end parts which connected, respectively, to the leading edge and the trailing edge of the air-bag is less than the width of each of the two

layers forming the air-bag extending between the said two connections. Thus again the fabric of the air-bag is initially wrinkled or folded due to the fact that the length of the tether between the connections is less than the length of the fabric elements between the connections.

In each of the above-described embodiments, it is to be appreciated that the or each tether is only connected to the fabric elements of the air-bag at opposed ends of the tether, so that, when the air-bag is inflated, the tether extends across the interior of the air-bag.

Whilst the invention has been described with reference to embodiments in which the tethers are connected to the air-bag by having parts of the tether trapped between superimposed elements of fabric or the like which are then secured by stitching, with the stitching "trapping" the ends of the tethers, the tethers could be held in position in other ways, for example by using an adhesive.

In the present specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".